Relevance of incorporating unit commitment constraints in long-term energy-system planning models

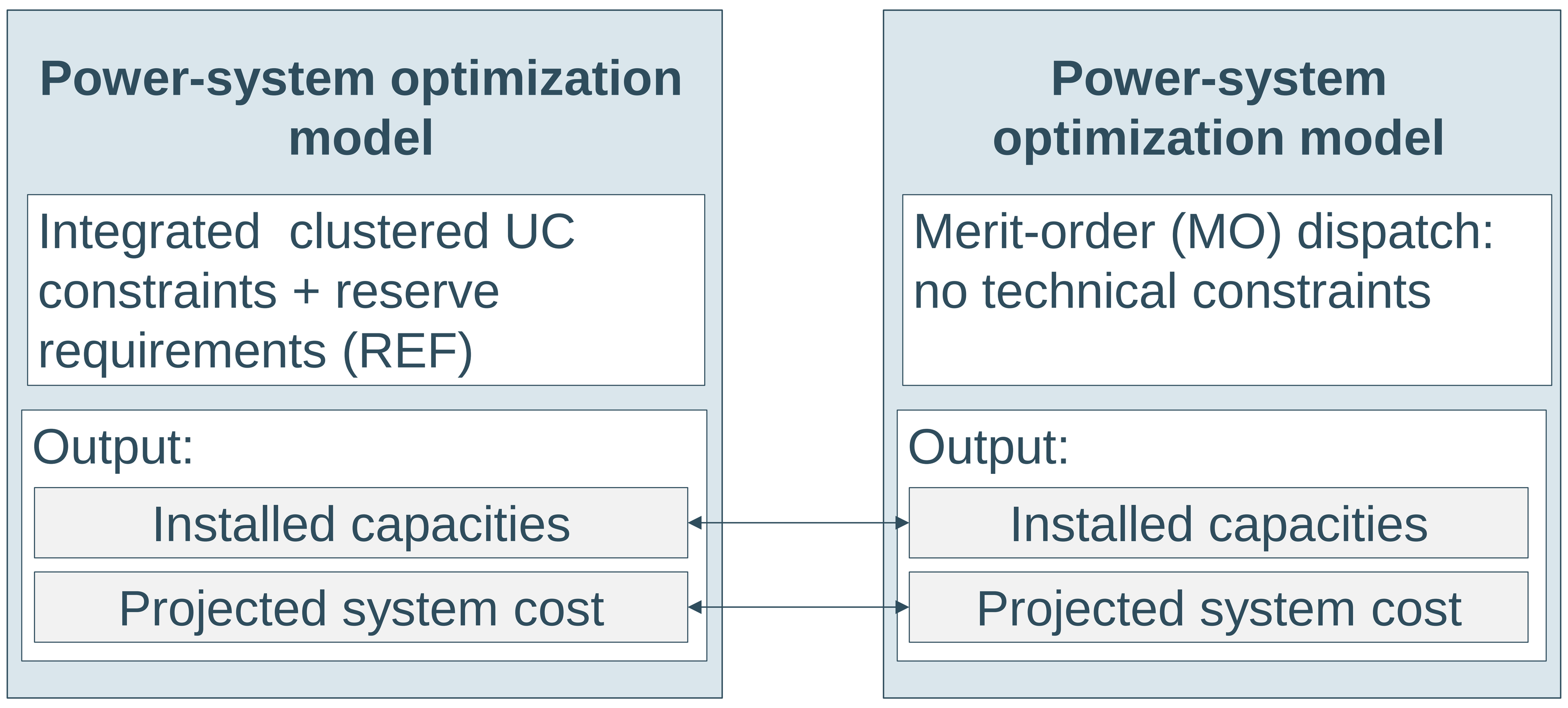
Kris Poncelet, Erik Delarue & William D'haeseleer

Department of Mechanical engineering, KU Leuven Leuven, Belgium

Context

1. Long-term energy-system planning models (e.g., MARKAL/TIMES, NEMS) frequently used for analyzing transition pathways for the decarbonization of the overall energy system (incl. electrical power, heating, transportation, etc.)
2. To limit the computational complexity, a low level of technical detail typically used for modeling the operation of the electrical power system
3. Increased need for flexibility due to rising share of intermittent renewable energy sources, such as wind and solar PV

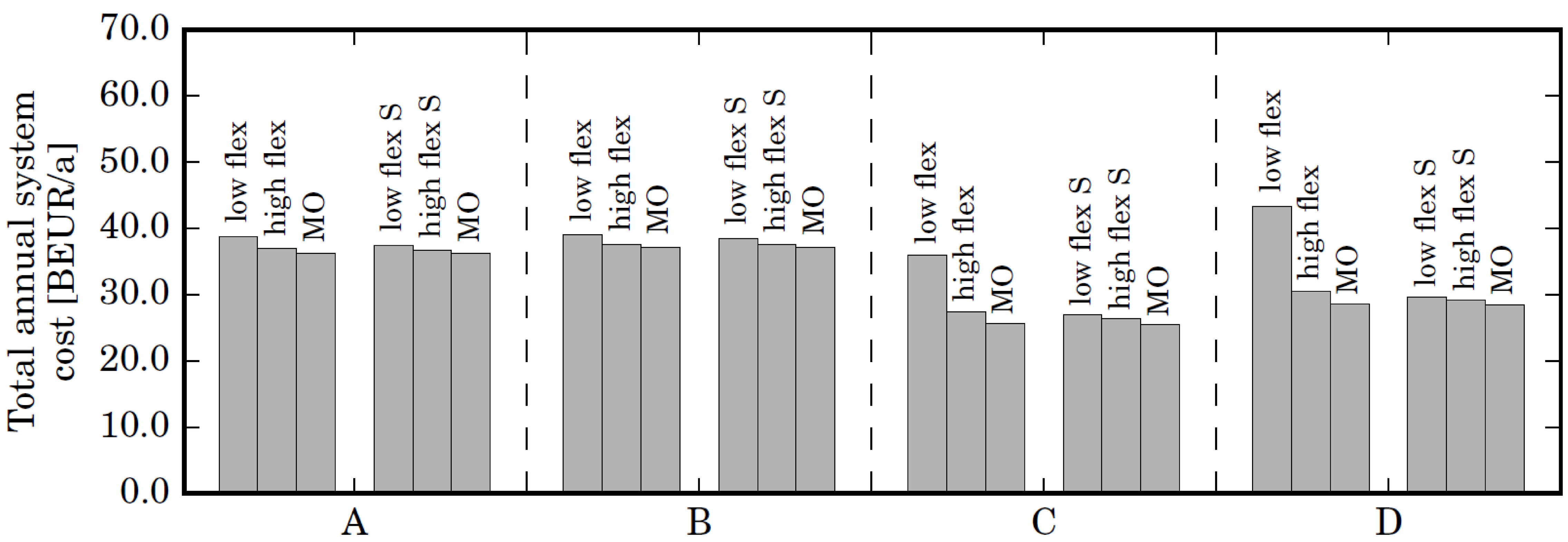
Methodology

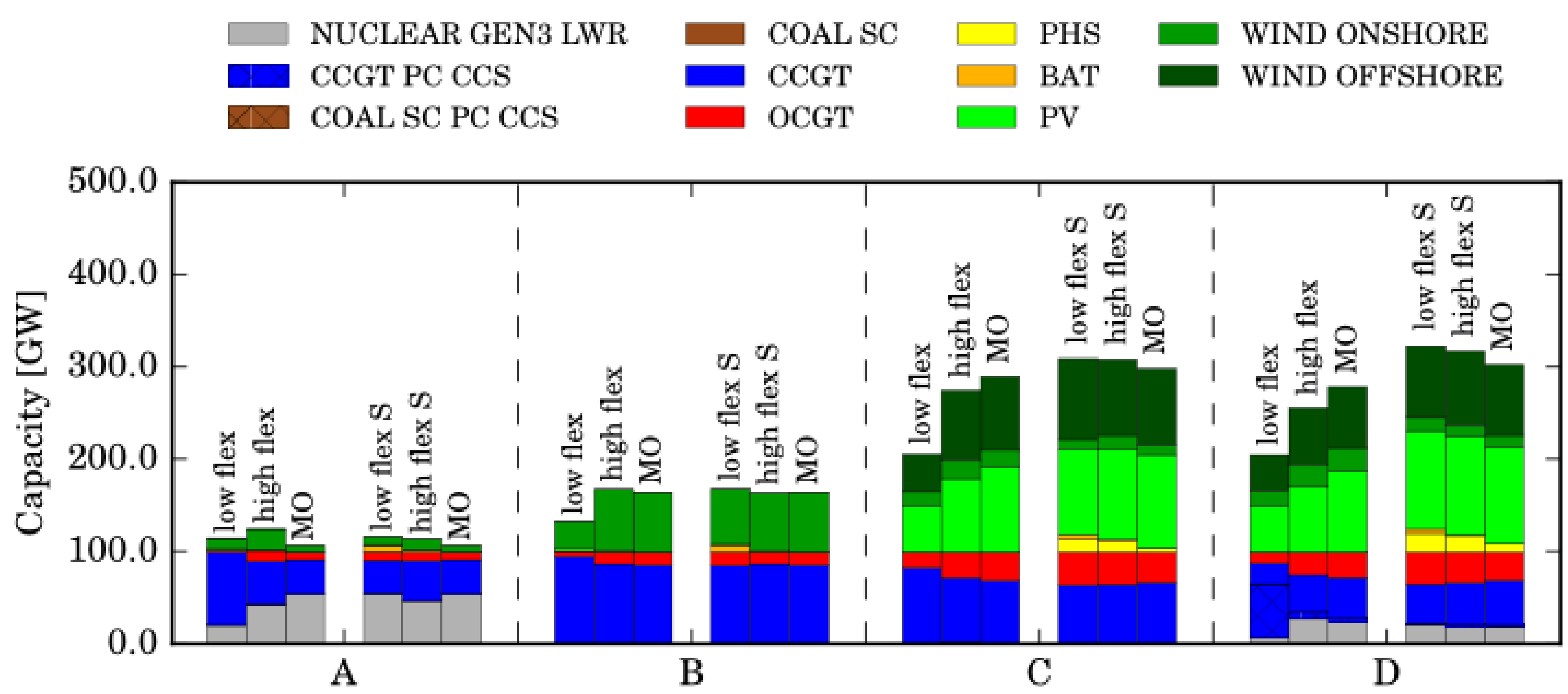


1. Varying capacity mix
2. Varying assumptions regarding available flexibility

Case	low flex	high flex	low flex S	high flex S
Flexibility of thermal power plants	low	high	low	high
Investments in storage allowed	no	no	yes	yes

Relevance of incorporating UC constraints





1. In most cases, limited impact on projected total system cost (1.5-7%) and capacity mix
2. Main exception: investments in storage technologies
3. Assumptions regarding available flexibility have a large impact on results:
   - Might be unrealistically restrictive => consider options to increase flexibility
   - High impact on investments in storage technologies

Further work

1. Less computationally demanding formulations of the clustered UC constraints
2. Impact ofassumptions regarding system needs: sizing of operating reserves and inertia

Contact: Kris Poncelet – kris.poncelet@kuleuven.be